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W O R K I N G P A P E R

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THE PROPOSED ARPANET DIVESTITURE:
LEGAL QUESTIONS AND ECONOMIC ISSUES

BY

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SUMMARY INTRODUCTION

ARPANET has been an experimental venture designed to test the efficiency, reliability and economy of a packet-switched, value-added network for computer communications. The experiment's success, measured by the satisfaction of present users and the increasing demands of prospective users for admission to the system, raises the question, what institutional form should a fully operational system take? Specifically, the issue for ARPANET's planners concerns the structural alterations that will be required for the network to meet the needs of network users and, at the same time,

advance the public interest.

For one school of thought, the immediate answer to the planners' question would call for ARPANET's transfer from public to private hands and for its transformation from a single firm into a number of firms competing for the user's dollar; prices and quality of network services would be established not by centralized administrative decision, but as a function of consumer demand.

This position, that private and public interests in an optimally functioning network would best be secured by the discipline of market forces, can be challenged on at least two grounds. It can be argued, first, that because ARPANET attained its initial success while under exclusive federal proprietorship, government control of its operations is essential for success to continue. Second, it can be argued that, given the highly delicate nature of the network's mission--its need to assure error-free, high quality service on an uninterrupted basis--network performance cannot be left to lax market processes, and requires instead the imposition of close regulatory restraints.

There are answers to these challenges. To begin with, the fact that ARPANET's success on an experimental scale

occurred under full government supervision has little bearing on the prospects for success on a dramatically expanded, fully distributed scale; centralized control, appropriate for mission-oriented research, may be totally out of place in a system whose paramount goal will be responsiveness to consumer demand, a goal characteristically set in our economy for independent, vigorously competitive firms. Second, our economy has also historically left the provision of a wide range of vital goods and services--housing and health care are two examples--to private firms operating in largely unregulated markets.

No matter how compelling one or the other set of objections may at first appear, neither should be mistaken for a satisfactorily complete defense of the position advanced, free market or government control. The intervention of larger questions, questions of internal efficiencies and external effects, makes resolution of the economic issue far more complex than either categorical position would have it appear.

However complex the economic issues, they are further complicated by legal questions, for regulatory decisions already reached in other sectors may foreclose the appropriate economic solutions. Thus, the mere fact of ARPANET's function-

al proximity to other, already regulated systems of other firms, like Bell and Western Union, may spur the FCC to regulate the network as well. To permit the network to operate outside the regulatory pale, yet alongside presently regulated common carriers, may be seen as posing a sufficiently serious threat to the integrity of administered common carrier price structures to warrant the commission's extension of the regulatory fabric to the emerging network. And, for its part, antitrust law might forbid the implementation of centralized structures that would otherwise produce the most efficient network operations.

Because the complex interplay of law and economics bars an easy answer to the question of what form the future ARPANET should take, this paper will undertake an analysis of the available alternatives and the possible implications of the adoption of each. Since it is to the objectives stipulated for an ideally functioning ARPANET that appropriate structures must conform, the paper begins, in Section I, with a brief statement of these objectives. Because the institutional choice cannot fruitfully be cast in terms as stark as regulation on the one hand and free enterprise on the other--because, indeed, under our legal system all conduct is

regulated, with the regulatory question being one only of degree, not kind-- the various institutional alternatives are depicted along a continuum, in Sections II-V, with the most heavily regulated form, the public firm, considered first and the less heavily regulated forms considered in successive sections.

The organization of the paper can be anticipated synop-
tically:

I. OBJECTIVES OF THE FIRM

The ideal toward which the ARPANET should be structured consists of a fully-distributed, internationally-linked network offering a wide variety of services designed to meet the computational and retrieval needs of the broadest range of public and private users; communication and maintenance costs, errors and delay, would border on zero. These parameters in turn suggest the conditions that must obtain for the network to flourish: because success in the terms described will depend significantly on the attainment of presently unrealized technological advances, network condi-
tions must be highly conducive to innovation; because the network will be preeminently a service institution, it must be situated for flexibility and responsiveness to consumer demand.

II. THE PUBLIC FIRM

As presently situated, ARPANET is a public firm, which is to say that it is a firm all of whose operational decisions are made by, or made the responsibility of, a governmental body, the Advanced Research Projects Agency. Successful as an experimental venture, ARPANET runs counter to this country's governing economic philosophy which favors lodging in private firms full responsibility for all operational decisions, requiring their transfer to governmental bodies only when decisions reached in private markets fail to conform to larger public objectives. Moreover, operation as a public firm appears particularly inappropriate for a commercially-based network whose objectives require that it be situated in a context hospitable to sustained innovation and responsiveness to consumer demand. Whether less extreme forms of government control--through government retention of parts of the network, or through the network's treatment as a common carrier--will be necessary to secure the public interest, or whether relatively unregulated behavior by autonomous firms will be sufficient, is considered in subsequent sections.

III. REGULATION BY RETENTION

As it is now the ARPANET's exclusive proprietor, the federal government is in a position, when divesting the system's components, to impose conditions upon their use by grantees. When divesting its resources generally--the grant of public lands is a central example--government's position traditionally has been to impose few, and relatively light, conditions on the grantee. There is every reason for this posture to be taken in the ARPANET divestiture. Whatever the level of conditions imposed, care must be taken that, in the transfer of ARPANET hardware and software, present network contractors not be unfairly favored--by reason of their present possession of proprietary data developed in the course of their network contracts--over non-contractor bidders; lack of vigilance on this front may be expected to produce unwanted monopoly effects in the divested network. Yet, equalizing barriers to network entry should not be a universal goal: interests in maintaining the present high performance levels during the network's transition from public to private ownership may, for instance, require the discriminatory disposition of certain other ARPANET assets.

IV. DIRECT REGULATION: THE FCC

If the divested ARPANET is to be regulated to any substantial degree, the most likely source of regulation will be the FCC, and treatment of the network as a common carrier will be the most likely form of regulation. While it is relatively clear that the FCC has the power to regulate a divested ARPANET, it is far less clear that, as a practical matter, FCC regulation and common carrier status would be prudent. The market to be occupied by a divested ARPANET possesses none of the natural monopoly contours that traditionally justify the common carrier status. Second, the network's critical need for a high degree of innovation seems less likely to be met in a regulated setting than in an unregulated one. Finally, the FCC's historic inclination to stifle emerging technologies in favor of the technologies employed by entrenched, already regulated firms may seriously impair the network's prospects from the start. In any event, the FCC, in its Computer-Communications Inquiry, has revealed no clear disposition to regulate ARPANET-type systems at the present time; eliminating "hybrid data processing services" from its present regulatory plans, and defining the

hybrid data processing service as "a hybrid service offering wherein the message-switching capability is incidental to the data processing function or purposes", the Commission appears effectively to have excluded regulation of the ARPANET which would bear many of these characteristics.

V. REGULATION BY THE MARKET

The analysis to be advanced in sections I-IV will suggest that the network's private and public objectives will for most purposes be met by situating the network in a vigorously competitive environment free from significant government control. However, the notion may persist that for one particularly sensitive area of network performance--quality of service--decisions made in private markets will fall short of social goals and government control of these decisions through traditional regulatory techniques may be deemed appropriate. This section examines two market alternatives to quality regulation that may in fact more efficiently reach the identical goals. First, because the federal government will be a prime customer for network services, it can, through conditions included in its purchase agreements, stipulate network maintenance of the desired standards; under

by unauthorized outsiders.

These are, to be sure, goals, not present reality, but they do suggest the contours of an ideal toward which the system's operation should be directed.¹ This statement of goals indicates, if nothing else, that the ideally functioning network must be highly responsive to the needs of its users, from private firms, academic institutions and government agencies. Further, the chasm that exists between the technology needed for the ideal to be achieved and the technology that is presently available suggests the important extent to which the network's managers must commit their resources to innovation.

This informing need, responsiveness to consumer demand, particularly as responsiveness is a function of innovation directed toward demand, indicates the inadequacy of the public firm--a firm all of whose operational decisions are made by, or made the responsibility of, a governmental body--to provide the desired kind and level of services. Lacking a price mechanism sensitive to competitive forces, lacking any basis for receiving accurate signals as to performance and consumer needs, lacking any spur to business-oriented innovation or any road map identifying the proper direction

I. OBJECTIVES OF THE FIRM

Ideal performance of the ARPANET can best be described functionally. As a goal, the network would seek to offer a wide variety of services tailored to meet the information processing needs of the broadest range of users. Access between any two points in the world would be possible, at high data rates and with communications and maintenance costs, errors and delay, low in comparison to other system costs. The system would be fully distributed and autonomous so that malfunction or disaster at any node would not affect the rest of the system; users would enjoy sufficient security to exchange messages with negligible concern for interference.

this technique, called "regulation by purchase," network compliance with conditions in government contracts may, depending upon applicable economies of scale, produce network implementation of identical service standards across the board, for private as well as government users.

Second, under a technique called "regulation by cooperation," individual network participants may find it in their interest to band together for the limited purpose of prescribing uniform interconnection standards; care must be taken, however, that cooperation, even for these limited purposes, not run afoul of the antitrust laws.

CONCLUSION

A conclusion, rehearsing the points discussed in the paper and the recommendations reached, appears at the end of the paper.

While these decisions are common to all firms, the conditions under which they are made will vary with the character of the firm and with its regulatory setting. In the private firm, decisions are largely left to managers and boards of directors, to be made according to the objectives for the firm set by them or the firm's stockholders. Even for the private firm, however, there are some regulatory constraints on decision. Antitrust strictures, for example, caution the firm against setting prices differentially or below cost, no matter how profitable either strategy may appear. A pharmaceutical company's decisions respecting the quality of its drugs may be importantly confined by Food and Drug Administration rules, and its decisions respecting marketing limited by Federal Trade Commission rules on deceptive advertising; in these last two cases, the ambit for decision will be further circumscribed by the threat of private actions brought by injured consumers and competitors.

In the so-called regulated industries -- public utilities and common carriers -- some managerial decisions are, like the decisions made by private firms, hedged by general legal rules. Other decisions are preempted altogether.

II. THE PUBLIC FIRM

A. TOWARD A REGULATORY THEORY OF THE PUBLIC FIRM

The behavior of all firms, private or public, regulated or unregulated, can be described in terms of the operative decisions the firm routinely makes. With respect to the goods or services supplied by the firm, these decisions embrace price, quality, marketing techniques, and the materials and labor employed. The decisions involve, too, judgements respecting the level of investment to be committed to plant and research and development, and the rate of return to be derived from investment.

summarizes the probable effects on network operations of largely unfettered markets and explores two specific market alternatives to regulatory techniques.

for innovation to take, the public firm seems poorly placed to operate an optimally functioning network. This is not to say that the public firm's structure for decisionmaking could not, with some work, be fashioned to simulate the more responsive decisional structure possessed by private, competitive firms -- indeed it could. The point, rather, is that if a structure disciplined by the market would function best, then it would seem more efficient to bypass simulation and get the real thing.

To conclude that full government control of network operations through management of the system as a public firm would bring network performance far short of the stated ideal leaves unresolved the entirely problematic question of the relative extents to which government control and market discipline should coincide in the network's management for the ideal to be approached. This question is considered in the succeeding sections of the paper. Section II examines the public firm, both as a functional entity and as a paradigm for regulation generally. Section III. examines regulation through government retention of certain network components and Section IV direct regulation on the common carrier or public utility model. Section V

The government agency charged with overseeing the operations of a regulated firm may be empowered to determine the firm's overall revenue requirements, a figure it derives from measurement of the firm's operating costs and costs of capital. Determination of revenue requirements in turn affects other of the firm's decisions: the firm's managers will be dissuaded both from incurring expenses that they know the commission will disallow and from paring expenses that, no matter how inefficiently applied, they expect the commission to tolerate. At the same time, the regulated firm's decisions respecting capital expenditures or alterations in service are limited by the prerequisite of commission approval; accounting procedures, too, must be compatible with commission needs. And while the firm's revenues are prescribed in the aggregate, the aggregate figure is not the only source of limitation on the firm's pricing decisions. Thus, for example, under the Communications Act's requirement that carrier rates be "just and reasonable," the FCC enjoys the power to require alterations in tariffs that may in its judgement be too high or too low, whether measured by the cost to the carrier of providing the tariffed service or by its value to the user.

This comparison of private and regulated firms sheds some analytic light on the regulatory process generally and on the place of public firms in our economy. It should be clear from the case of the private firm, and even more so from that of the regulated one, that the process of regulation involves no more than the removal from firm to government of part of the power to make some decisions and, in some instances, of the power to decide altogether. This suggests that the difference between the private and the regulated firm is one not of kind, but degree, the degree to which decisions have been transferred from the private to the public sector. This further suggests that the difference between private and regulated firms, on the one hand, and the public firm on the other is also importantly one of degree: in the case of the public firm, all operational decisions are governmentally made, although of course, government in its decisionmaking will, like private and regulated firms, be influenced by consumer preference.

Unlike these firms, however, the public firm will be affected
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by voter preference as well.

There is, to be sure, a difference of kind implicit in

the regulatory process, one that relates, however, not to where decisions are made -- in the private or public sector -- but rather to the objectives toward which decisions are directed. The determination to regulate at any level implies a judgement that the performance, or, more accurately, the effects of performance, of the unregulated firm, maximizing its internal economic objectives, will not correspond with government's perceived social and political, as well as economic, objectives. Thus, the unregulated firm may consider that its interests are better served by the hoarding of gold bullion than by the purchase of pollution control equipment and that they would be served better still by heavy contributions to the campaign coffers of malleable legislators. At the least stringent level of regulation, laws establishing air quality standards, curtailing traffic in gold and proscribing corporate gifts to political campaigns are intended to confine decisionmaking to a range more consonant with perceived societal needs.⁵ More serious, systemic departures of private firm behavior from governmental objectives may call for the imposition on the firm of public utility or common carrier status.

The reasons for regulation are even more apparent at regulation's extreme, when the performance of private firms sufficiently departs from public needs to warrant the formation of public firms, either from scratch, as in the case of ARPANET, or through the nationalization of existing private firms. Wartime needs, unsatisfied both by the free market and the incremental process of regulation, represent at least the most dramatic predicate for the nationalization of private firms. Other functions -- defense, the administration of justice are examples -- are viewed as so central to the political system that the need for exclusive government control has been treated as self-evident. And, regulatory expedience, though a less obviously compelling reason than war or politics, also accounts for the formation of public firms. A commission that assumes control over a public utility's rate of return may soon find that the rate established has produced untoward effects on the utility's pricing and investment decisions; requiring the firm to relinquish these decisions, too, the commission may discover that, as a consequence, wrong decisions are being made on still other fronts, a phenomenon that McKie calls the "tar-baby effect".⁶

At some point, full public control of the firm's decisions, which is to say full public proprietorship of the firm, may appear the most efficient solution. Efficiency, more than any other reason, may account for a situation in which "it is not unusual to find that extensively regulated sectors of the economy succumb to complete socialization with government ownership and operation. In the last century, privately-owned roads, canals and bridges passed from regulated activities to government operations. The socialization of water supply and urban public transit is nearly complete."⁷

B. FORMING THE PUBLIC FIRM

If the failure of market forces to meet public needs is not the exclusive reason for the formation of public firms, it is at least a predominant one. The existence of three such public needs -- reliability of service, equality of access and innovation in techniques -- underlies ARPA's decision initially to structure ARPANET as a public firm, and it may be helpful at this point to examine the dimension of these needs generally and the nature of governmental response. This is not to suggest that needs of this sort are best met by public firms, but only that they are said to

be by those whose word is law.⁸ That the public firm is not the only, or even the most efficient, means for meeting compelling public needs should be evident from reflection on the performance of some public endeavors designed to achieve reliability, equality and innovation.

1. Reliability

Together with related historical and political factors, the need for a high degree of reliability is popularly perceived to underlie the decision to operate the functions of national defense as a public firm. While the need to internalize in government the power to make decisions respecting the uses of the defense establishment should be self-evident, it does not necessarily follow that the production and deployment of materiel and services are also best accomplished within the public sector; indeed the military presently relies heavily on private firms for the production of materiel. That the military service function has largely been kept internal to the government can be ascribed to a factor not reproducible in the market, at least not since passage of the thirteenth amendment: government's power to

compel its citizens to perform military or alternative service. Although this power might appear particularly attuned to the level of reliability represented by a captive, readily mobilized labor force, its exercise indicates only that the military is paying its servants less than they could command in the marketplace. Recent moves to abolish the draft, and to replace it with schedules of compensation more nearly enjoying parity with labor's market value, suggest that the conscription power is not a prerequisite to reliability and security.

2. Equality

The problem of equality in access arises in its most graphic form when the cost of vital services for which demand is relatively inelastic -- municipal transit and postal service are two -- exceeds what an important segment of the public can reasonably be expected to pay. To avoid undesired distributional effects, government could permit provision of the needed services on a competitive basis and achieve equalization through direct payments to the poor either in cash or, more effectively, in vouchers, as is done with food stamps. Alternatively, government could channel its subsidy directly to the private entrepreneur, requiring in return

pricing that, though uniform, is at a level the poor could afford. Government could also give the private enterprise a wide latitude for price discrimination, prohibiting resale by the low-price buyers and exacting as a condition for its permission the firm's agreement to price services for the poor at an affordable level, obviously below the firm's average and even marginal cost; presumably, the firm would make up its losses in these markets by capturing consumer surplus in more affluent markets. The first two approaches are generally shunned because government seems to prefer covert to overt subsidies. While the third approach roughly approximates the one employed in the differential pricing of business and residential telephone service, there is no evidence that residential service is provided at less than marginal cost and, in any event, the latitude allowed has not been sufficiently broad to provoke undesired political reaction.⁹ The governmental solution, motivated by the need for both equality as actually enjoyed and equality as perceived, has in many areas been the public firm, setting a single below cost price for its services, subsidizing its activity covertly from tax revenues.

3. Innovation

The formation of public firms may also be prompted by the existence of areas of significant technological need, the resolution of which will not, for one reason or another, be achieved in the private sector. The very magnitude of the problem to be solved may be thought a sufficient condition to goad the profit-seeking firm to its solution, particularly if the firm is abetted by the promise of patent protection for its discovery. Yet, the profits to be derived from marketing a discovery do not necessarily correspond with the magnitude of its need, a phenomenon that may go far to explain the poverty of innovation in instructional materials for public and private education. At the same time, elements of risk, associated with any research and development venture, may for the private firm render the opportunity costs of research expenditures unbearably high. Finally, the patent law, never a particularly efficient system for encouraging needed innovation, has in recent years revealed itself to be an increasingly creaky device, its promise hedged on all corners. It is in these areas of great unmet needs, where the calculus of anticipated profits, risk and patent protection weighs against the private commitment of resources to innovation, that more direct government intervention becomes appropriate. Intervention may take the form of direct

subsidy, as in ARPA's dramatically successful program of support for research in advanced computer capabilities, or it may take the form of the public innovative firm as, for example, ARPANET.

C. DISSOLVING THE PUBLIC FIRM

Because it is an instance, not an exception, of government regulation, the public firm is subject to many of the same stresses that affect regulation generally. The tug of the marketplace may first be felt in assertions that private firms will more efficiently achieve relevant public goals without a particular legal rule than with it. On an institutional scale, the demonstrated superiority of private firms over public firms in reaching public goals may similarly call for the transfer of all or parts of the firm from the public to the private sector. The mission-oriented public firm, like ARPANET, once having marshalled its resources to accelerate or even initiate change, may be expected quickly to fall into a pattern of resisting change, a particularly undesirable posture in fields where continued flexibility and invention is essential.

Although the transfer of public firms to private and competitive markets is commonly characterized as divestiture, it may be both more accurate and helpful to treat the transaction not as a sale but as an instance of deregulation. Just as the regulatory loop can be run forward, from the largely unregulated private firm, to the regulated firm, to the public firm, so it can be run in reverse; shedding some of its components, retaining others, the public firm can be introduced into the market as a private firm regulated to varying degrees. This analysis suggests that the decision to divest involves judgements respecting not only the extent to which previously regulated components should be deregulated but also, by implication, the extent to which the firm's behavior should remain regulated, taking into account the effect on regulated components of the newly deregulated components.

Because it is so thoroughly imbued with regulatory implications, the decision to divest a public firm is far more complex and charged with second order effects than other instances of government sale -- sale of army surplus stock is an example -- to which easy comparison might be made. For this reason, the decision to divest deserves at least the level of attention paid to the decision to regulate. The

central most difficult task is determining which components should remain regulated, which should be deregulated, and the extent of deregulation for any component. A presumption favoring the market over the regulatory solution may make decision easier in close cases, but is no universal guide. The process is further complicated by the fact that public ownership may entail concessions not immediately available to private owners -- reduced government rates on telephone lines, for example, or the capability of below marginal cost pricing -- concessions likely to generate false signals respecting the prospects for the firm's success in competitive markets. Present, too, is the need to structure deregulation to accommodate the contemporary inclinations of private capital markets: public goals embedded in the firm's design may sometimes have to be replaced by others for the needed level of private investment to be attracted.

Divestiture, or deregulation, of the public firm can be accomplished through three techniques, none mutually exclusive, which are examined in Sections III, IV, and V, which follow. As discussed in Section III, some parts of the firm may be transferred to private entrepreneurs and other parts retained.

in the public sector, with the portion retained used to control operation of the portion divested. A crude comparison is to real property conveyances of fees simple determinable or on condition subsequent: enjoyment by the transferee of the estate conveyed may be made to depend upon his compliance with conditions imposed by the grantor, the penalty for noncompliance being forfeiture and reversion of his interest. Or, as considered in Section IV, some or all components of the firm may be conveyed to private managers to be operated on a public utility or common carrier basis. Finally, as discussed in Section V, some or all elements may be conveyed with few if any reversionary ties and with little if any direct regulation, with reliance placed on the market, together with the general body of legal rules, to satisfy public objectives.

III. REGULATION BY RETENTION

As presently structured, ARPANET is a vertically integrated public firm which, though it has contracted with private firms for the performance of some functions, has retained control of all. While the public interest may press for ARPANET's disintegration and for the transfer to private firms of institutional parts and functions, the public welfare may equally command the retention of some components in the public firm or in government generally. Thus, if it is felt that, left to the discretion of private firms, the quality of network services will deteriorate to

a less than acceptable level, ARPA may decide to retain institutional functions incorporating critical quality decisions -- basic system programming functions, for example. Or, if perpetual private ownership of network components is seen as too chancy a route, the agency could impose a specific time limitation on the transfer, as in typical leasehold transactions. Alternatively, ARPA could hedge its grants with performance criteria, requiring as a condition of continued private ownership the provision of service at some specified level of quality. In part, the comparison here is to the disposition of land in England after the Conquest: while interests in the efficient operation of the state called for the transfer of land from the sovereign to selected subjects, they called, too, for the imposition on grantees of conditions that, if unperformed, would cause title to revert to the state.

A. THE GENERAL SETTING

Because in the proposed ARPANET divestiture it is government assets that are to be conveyed, reference to two well-developed instances of government transfer may be instructive -- the conveyance of public lands and the

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grant of licenses for use of the electromagnetic spectrum.

1. The Public Lands Analogy

Like the English sovereign, the United States government has disposed of the bulk of its land in the hope of achieving objectives that could not as well be met if the land were retained. In some cases, the purposes of the government grant were general: to stimulate the settlement of sparsely populated areas and to encourage private ownership of land. In other cases, the purposes were more specific: to encourage the development of railroads, for instance, or highways and schools.¹¹ Unlike the English sovereign's grants, the federal government's have commonly been made in fee simple absolute with only the most narrow and immediate strings attached: duration of ownership was to be perpetual, save of course for the always prevalent prospect of eminent domain; and the conditions imposed on the grant were rarely burdensome -- development and cultivation of the ceded land for three years under the Homestead Act, for example.¹²

These characteristics of public lands policy -- perpetual ownership encumbered by few conditions -- seem particularly fitting for divestiture of ARPANET's components. To begin with, the general argument for perpetuity is

especially persuasive in the case of the network: "the market tends to operate more efficiently when the time-tenure of the property interest is of long duration, since predictions about the usable life of specialized capital equipment investments are thereby made less critical."¹³

The network owner for whom loss of his firm's franchise is a relatively imminent prospect, will be less disposed to make needed capital and research and development expenditures than one who is assured of perpetual ownership of a competitive firm, particularly since, upon loss of his franchise, the short-term owner can be expected to derive sharply reduced value from his plant and the fruits of his invention.¹⁴ The same factors, together with the need for flexibility in a vigorously competitive setting, would appear to caution against imposing serious restrictions on permissible use.¹⁵

The fact that, unlike public land transfers, ARPANET, and its divestiture, are highly experimental ventures, does not of itself call for the imposition of strict durational or use constraints, for the government possesses in this context a posture not materially present in the context of land transfers: its position as the single most powerful

buyer of network services. As discussed in Section V, this element of leverage can be handily employed to move private decisions respecting quality of services in the desired direction. Government purchase contracts can also be expected to exert some influence on other firm decisions, such as pricing, marketing and investment, although, with respect to these, the market, together with generally prevalent private and public law rules may be relied on to conform firm decisions to the desired criteria.

2. The Spectrum Analogy

The demonstration of widespread inefficiencies in current FCC management of the electromagnetic spectrum, under which portions of the spectrum are allocated to private users on a durationally limited and heavily conditioned basis, indicates the wisdom of eschewing a similar approach in the ARPANET divestiture. Moreover, proposals both for placing spectrum management on a market footing,¹⁶ and for designing experiments to test the market hypothesis,¹⁷ share a view of the spectrum resource that is particularly applicable to ARPANET. Acknowledging that spectrum is a resource, this view maintains that, "While it is true that the Government appropriated the resource in 1927, it did so

not on the ground that the Government was entitled to the wealth created by use of the resource, but rather on the ground that regulation was necessary for the resource to be useful at all.¹⁸ The relevant point is that ARPANET, like government management of the spectrum, originated in a context in which the market alone would produce undesired results: in the case of the spectrum, unregulated uses would overlap to an intolerable degree; in the case of packet switching, technological and regulatory uncertainties would discourage any private firm from making the necessary investment in plant and research and development. Once it is shown that the original market dilemma can be meliorated -- as in the case of spectrum -- or that it has disappeared entirely -- with ARPANET's production of the needed basal innovation -- largely unconstrained divestiture to the private sector becomes timely.

3. Guidelines for Divestiture

All of this suggests two principles that should guide the disintegration and parcelling out of the ARPANET. First, components of the network should be made available to bidders on a basis that will enhance innovation and

flexibility within their firms; this means, specifically, ownership unlimited in time and bounded only by the most slender, expedient conditions. Second, if the market is to be relied upon to encourage the most efficient use of the network's components, then bidders for these components must be treated on the terms most consonant with maintenance of competitive conditions; simply, no single bidder should be given, from ARPANET assets, a competitive advantage not available to all others on equal terms. The first principle bears on the question, how the network is to be divested, and the second on the question, how much. It is to this second question that discussion now turns.

B. THE ASSETS AND THEIR DIVESTITURE

ARPANET possesses two institutional elements of value to private bidders, one easily appropriable, the other less so. The first, appropriable, class of assets consists of hardware -- IMPS, TIPS and interfacing equipment situated at the IMPS for connection with the hosts -- and of software -- undisclosed proprietary data in programs essential to operation of the system.¹⁹ The second, less appropriable,

class consists of the network's going concern value which, for present purposes, can be described as a vessel giving its possessor some competitive advantage in making those operational decisions central to any firm, private or public.²⁰ Transfers of assets in the first class can be viewed as involving the products of decisions already made -- investment decisions respecting hardware and innovation. Transfers in the second class involve instead the power to make decisions in the sense that some or all of the decision-making powers divested are, for successful ARPANET bidders, enhanced in a way that they are not for unsuccessful bidders and nonbidders. This is to say that if, as between A and B, competitors in the packet switching business, A has ARPANET's going concern value and B does not, A will with respect to some or all of its operational decisions -- pricing and marketing, say -- enjoy advantages that B will not.

1. The Appropriable Assets

The decision whether ARPA should retain existing network hardware -- IMPS, TIPS and interfacing equipment -- or whether the hardware should be divested and, if so, on what terms, calls for some relatively straightforward

judgements respecting the desired level of barriers to entry, distributional effects and levels of innovation. Thus, if relatively free entry is desired, ARPA could retain title to the hardware and lease the needed equipment to successful bidders on terms less forbidding than those entailed by either initial capital outlay or indebtedness. Alternatively, if some hurdle to entry is perceived as appropriate -- possibly to separate the serious and resourceful entrepreneurs from those that are undercapitalized -- then outright sale of the present stock of hardware may prove to be a desirable screening technique. Unless ARPA finds good reason to favor present network participants over prospective ones, it should require participants who become bidders to pay for hardware presently in place in their establishments on terms identical to those required of new entrants. Finally, ARPA may, under either the sale or lease approach, employ the price mechanism to modify the conditions for hardware innovation; by adjusting prices up or down, the agency can increase or decrease the relative desirability to users of purchasing, or committing research and development resources to, network hardware.

Technical knowhow concerning the network's most efficient operation under present conditions might appear generically indistinguishable from ARPANET's hardware assets. In fact, it is vitally different: in some instances the knowhow is completely inappropriable -- because already in the public domain -- while in others it is too fully appropriable -- and, sequestered by private ARPANET contractors, is unavailable even to ARPA. In the first, inappropriable class of knowhow, there is, of course, nothing to be divested, all the information involved being freely and publicly available. The second class, on the other hand, raises a number of serious questions for divestiture policy. Should ARPA let this proprietary data remain in their present hands, for the exclusive use of private contractors? Should compulsory licensing at specified rates be required? Should ARPA appropriate the proprietary data to itself and, if so, should it license their use or should it inject the data into the public domain as it has done with other network knowhow?

However the other questions are resolved, it seems clear that the question whether network proprietary data

are to be left to the exclusive use of ARPANET contractors who become network bidders should be answered in the negative. To allow present contractors who become future bidders to retain as their own proprietary data developed in the course of ARPANET's developmental stage would confer on these firms a competitive advantage over entrants not occupying this privileged position and possibly deter entry by disadvantaged bidders altogether. While for reasons already given, some barriers to entry may be appropriate, this will be the case only if the height of the barriers is uniform.

It can of course be argued that present contractors who become network participants may be expected to behave like prudent patent and trade secret proprietors generally, licensing the use of their information to others at the profit-maximizing price; that the network information owner is a vertically integrated producer-supplier gives it no reason to discriminate against non-integrated suppliers by entirely refusing them access to the information product. Under this argument, the question then becomes one of the price charged. The general substitutability and relatively low cost of developing alternative information suggests that the price would not be one from which much in the way of monopoly profits could be extracted. Perhaps because it imputes

rational economic behavior to network managers, and because it ignores widespread but erroneous assumptions respecting the anticompetitive behavior of vertically integrated firms, this argument appears to make considerable sense.²¹

Moreover, there would seem to be no significant economies of integration -- no internal savings of external transaction costs -- peculiarly attributable to transfers of proprietary data and, consequently, no reason for the integrated network to favor its own branches to the exclusion of outside firms.²²

What may make a difference in terms of long run monopoly effects is not so much the fact that possession of proprietary data will give network contractors a competitive edge as the fact that, because the underlying research and development was government financed, the edge was obtained costlessly. Lacking the need to finance past investment from current data revenues, contractors may be more inclined to hold the data off the market, particularly if they believe that the exclusionary tactic, together with their vertically integrated posture, will pose significant barriers to entry.²³

If, for these reasons, it is decided that initial

knowhow advantages should be eliminated, there are available to ARPA a number of techniques for extracting the data from present contractors and achieving uniformity in knowhow barriers. ARPA could itself acquire the privately held proprietary data, either under the terms of its contracts with ARPANET contractors or, if these do not support such an approach, then possibly through a requirement that all bidders -- present contractors and prospective entrants alike -- disclose, as a condition to their bid being considered, any information they possess respecting the network's operation. Finally, ARPA might simply expropriate the contractor's information, making just compensation.

Alternatively, ARPA could require present contractors to license use of their information to all comers with revenues paid directly to the government, or it might permit the private retention of data and at the same time subsidize non-contractor entrants in amounts corresponding to their competitive disadvantage, possibly with a requirement that the subsidy be applied exclusively to the purchase of, or research and development in, information of the type being held by the contractor entrants. This last approach would appear particularly attuned to the goals of stimulating

program innovation within the network. In this same connection, if ARPA expropriates or otherwise obtains information presently held by contractors, the choice between making the information free and public, or licensing its use at a fee, should similarly account for the respective effects on network innovation of the two techniques.

2. The Less Appropriable Assets

Whatever the market value of ARPANET's appropriable, hardware and software, assets, it is the less appropriable assets that probably possess the greatest attraction for prospective network bidders. This is particularly ironic because, once hardware and software are excluded, there is little or nothing left in the ARPANET inventory that can be characterized as assets in traditional terms. The significant research and development that has brought ARPANET from an idea to an operational entity is, with the relatively limited exception of what is being withheld by private contractors, all in the public domain. "Going concern value" is scarcely discernible, particularly since, if the network is structured along competitive lines, there will be no single firm that can properly call itself a

successor to ARPANET. What is left is a customer base and goodwill in a highly specialized sense.

The customer base component of the ARPANET inventory has two aspects. The first derives from the needs of network users in quality and reliability of service. These needs, which will be particularly troublesome during the period of the network's transition from public to private ownership, might be met by a program of ARPA endorsement, with customers naturally drawn to those firms that bear some imprimatur of ARPANET affiliation. Yet, while proprietary data can be effectively subjected to licensing schemes, reputation cannot be so easily marketed. The technique of trademark licensing, popularly thought to serve a reputational guarantee function, is probably unavailable in this context. And, in any event, introduction of a franchising system, even if it could be mounted efficiently, might well contradict demonstrated interests in genuine competition.

Because of the difficulties and imperfections associated with a trademark licensing scheme, it can be expected that present ARPANET contractors who successfully bid for a share of the network will, because of the history of their associa-

tion, attract the bulk of prospective users, particularly during the critical interim period. This means, of course, that present contractors will, by reason of their past work for ARPANET, enjoy a competitive advantage with respect to new entrants not unlike the one they would enjoy were they permitted to retain proprietary data. Here, however, it would seem entirely wasteful, and not at all consonant with the needs of users during the interim period, to achieve uniformity in barriers to entry by requiring present contractors to disqualify themselves as bidders.

The second aspect of ARPANET's customer base consists of the almost certain prospect that successful bidders will receive a government contract for the purchase of their services, and with it the revenues and headstart possibly needed to serve the private sector as well. The implications of government purchase also bear directly on the question of what if any components ARPA should retain. If quality control and standardization are objectives which, for one reason or other, will not be reached through the operation of private markets, and if the most significant asset to be divested consists of a customer base having the federal government as its prime occupant, then it would appear that government, through quality and standardization conditions

imposed in its purchase contracts, will be in a position to reconcile network operations with welfare objectives. This is to say only that government could, through its special position in the market, stimulate the same conduct it could impose either by retaining the quality function within ARPA or prescribing regulatory standards directly. Of the three alternative routes, the first, involving conditions for purchase, seems the more flexible and specific and, for this reason, probably the best. This phenomenon of regulation by purchase, discussed in considerably more detail in Section V, suggests that, at least with respect to the quality and standardization function, the case for retention is an uneasy one at best.

IV. DIRECT REGULATION: THE FCC

The provision of telecommunications is in this country left to private enterprise. Elsewhere in the world, these services are commonly provided by government through public firms.²⁴ The international comparison underscores the boldness of American policy and the thrust of its governing presumption: wherever feasible, the provision of goods and services, no matter how vital, should be left to private firms. Both the policy and presumption permit a corollary: wherever feasible, private firms should be allowed to make their operational decisions unconstrained by government regulation. In the case of the ARPANET, this

means that, though presently a public firm, there is every reason for it not to continue as such. It means, further, that if the network is handed over to private firms, government control of firm decisions should be kept to the necessary minimum.

The general presumption against regulation gains compelling force from some historical and economic factors surrounding communications regulation generally and network conditions specifically.²⁵ If the divested network is to be regulated at all, regulation is most likely to come from the FCC which in the area of telecommunications characteristically works on an all or nothing basis: if a firm is regulated it is as a common carrier, with application of the pervasive congeries of price, marketing and other controls presently applied to telecommunications common carriers like the Bell System and Western Union.²⁶ Little if any room is left for incremental regulation, tailor-made to fit the needs of the regulated firm.

FCC control of the budding network appears inappropriate for another reason. Often inhospitable to newly emerging industries and technologies that appear to threaten the economic security of entrenched, already regulated, firms, the Commission has been known to regulate the prospective new entrant to a point at which entry itself is all but

impossible. This argument may be softened somewhat by hindsight: the protective stance has most frequently been taken in the broadcast context, in the form, for example, of rebuffs to CATV's perceived assaults on the integrity
27 of VHF operations; defenses on the common carrier side
28 have not in recent years been nearly so high.

A. REGULATION: CONDITIONS AND CONSEQUENCES

Together with these other considerations, there are two particularly salient reasons for FCC abstention. First, the market to be occupied by the divested network possesses few if any of the natural monopoly contours that traditionally justify imposition of public utility or common carrier treatment. Second, in an area critical to ARPANET's success -- innovation -- the performance of regulated industries generally has been seriously questioned. Because these two considerations, natural monopoly and innovation, form a central part of the argument against network regulation, they are considered here in some detail.

1. Natural Monopoly

A natural monopoly is said to exist in markets where

demand can most efficiently be met by a single firm. The cost efficiency of the single firm in natural monopoly markets is a function of significant economies of scale, unit costs declining as production scale increases, and of relative capital intensity, with the ratio of fixed to variable costs being continually high.²⁹ To the extent that these factors are present, a natural monopoly condition exists and a single firm is recommended; regulation of the firm, as a public utility or common carrier, is in turn seen as required to prevent the abuses popularly associated with monopolies.

The market to be occupied by the divested ARPANET appears to possess none of the characteristics of natural monopoly in a sufficient degree to warrant divestiture to a single firm. Two classes of capital outlay will be essential to the network's operation: a national transmission system consisting of telephone lines, microwave, and communications satellites, and terminal to network interface hardware and software. While the capital costs are high in both classes, the critical point for the ARPANET is that the necessary capital outlays have been and will continue to be made outside the network industry. The transmission facilities

to be employed by the network are either already in place -- as in the case of the Bell System -- or are being developed by non-network firms -- specialized common carriers,
for example, or domestic satellite entrepreneurs.
³⁰

Hardware and software costs, while they may be incurred completely within the network, need not be: lease and licensing mechanisms are available to spread out costs for the two items and reduce entry and exit barriers. At the same time, while packet technology will push the most significant variable cost of remote data services -- communications -- well below present levels, there is every reason to expect that, particularly in view of the low fixed costs, the fixed to variable cost ratio can be expected to be far below the level at which natural monopoly characteristics begin to surface.

2. Innovation

The argument that monopolistic firms are characteristically disinclined to innovate in their operations and in their products and services has been persuasively answered.
This does not mean, however, that regulated monopolies will
³¹
behave similarly. To begin with, the regulatory practice
of tying revenue to costs naturally produces some disincentive to innovate toward efficient operations. There are,
³²

to be sure, some counters to this general disincentive effect. While innovation aimed at internal efficiency may be deterred, innovation directed at the development of new products and services need not be, although, even here, the requirement of regulatory agency approval may be a dissuasive force. Also, because regulated rates are almost always based on the firm's past performance, and are set periodically rather than continually, the firm has some reason to innovate and cut costs in the interim, before new rates are set; the presence of regulatory lag may exert some pressures toward economy in operations, although whatever savings are achieved may in periods of inflation be cancelled by increases in costs.

While innovation doubtless occurs in the rate base regulated firm, especially with respect to the creation and capture of new markets, this does not mean that the level of innovation will be optimal or, far more important, that the innovation produced will be of the proper kind. Thus, for example, because its revenues are tied to its level of investment, the regulated firm can be expected to seize every available opportunity to enlarge its rate base, a capital intensive bias that may lead it to prefer research and development directed toward capital intensive, but comparatively inefficient, production and service processes.

Misdirection of investment in innovation may also occur if it is general public relations, not specific consumer needs,
³⁴ that supply the motive for invention.

This indicates only that the rate and direction of innovation are likely to be suboptimal in regulated industries whose firms are vertically integrated. Where there is some disintegration, and the firms supplying the regulated firms operate in a competitive environment, the degree of innovation with respect to the goods and services supplied that is present in other competitive sectors may be expected
³⁵ to prevail. The question, then, is whether, if certain components of the divested ARPANET are placed on a regulated, common carrier basis, other components, critical to innovation, can be isolated and left in a competitive setting. Unfortunately, because it is an entirely new system that is involved, and because it is in the nature of significant innovation that its outcomes and contours cannot be known at the outset, little can be accurately said about the proper locus of innovation until consumer needs become more defined and the outlines for responsive innovation become more clear. What can be said with somewhat more certainty is that, all else being equal, more in the way of appropriate innovation stands to be lost by placing any segment of the divested firm

on a regulated footing rather than on one that is competitive.

B. THE FCC'S AUTHORITY: A PRELIMINARY INQUIRY

It is at least arguable that the FCC's enabling legislation gives the Commission the power to regulate the components of a divested ARPANET.³⁷ Title I, which empowers the Commission to "perform any and all acts, make such rules and regulations, and issue such orders, not inconsistent with this chapter, as may be necessary in the execution of its functions,"³⁸ may be interpreted to justify the regulation of institutions whose activities, not falling squarely within the scope of the Act, nonetheless impinge upon the Commission's regulation of activities that do -- telephone common carriage and radio transmission. Perceiving a network threat to the integrity of the telephone system -- by sloppy interconnection or diversionary pricing, for example -- the Commission might find in Title I the required authority to regulate the network's activities generally. It was a rationale of this sort that formed the predicate for the Commission's regulation of CATV functions,³⁹ and, although there are important differences between the

CATV context and the present one, it is significant that the Supreme Court, in one of its infrequent reviews of an FCC decision, expressly sustained the rationale.⁴⁰

Whatever the case for the existence of a statutory power to regulate the divested network, it is far less clear that the statutory language and the underlying legislative history command or even warrant an exercise of the power to characterize the network as a common carrier. The Act's definition of "common carrier" is singularly unhelpful -- "'common carrier' ... means any person engaged as a common carrier for hire"⁴¹ -- and the legislative history is only slightly more enlightening: the statutory definition was said not to include "any person if not a common carrier in the ordinary sense of the term."⁴²

The "ordinary sense of the term," as it was understood by the Act's framers, may be generalized from three early instances of common carriage: ferryboats, railroads and the telephone system. Elements common to the three include a service, available to the public generally, for transporting persons, things or messages in unaltered form from one place to another. ARPANET would depart from these traditional common

carrier contours in all important particulars: use of the system will, in the near term at least, be confined to commercial and government buyers; the very reason for use will be to obtain some significant alteration of the message conveyed, often with additional data returned; and though, to be sure, messages will travel from one site to another, the ticket will as often as not be round trip, with processing, not switching, the significant function at the distant end.

C. THE FCC'S AUTHORITY: THE COMPUTER-COMMUNICATIONS INQUIRY

Although the FCC's own interpretations of its statutory mandate lend few more guidelines for answering the questions of whether and to what extent the divested network is to be regulated, the Commission's Computer-Communications Inquiry,⁴³ initiated in 1966, at least provides a helpful starting point. The Inquiry, which concluded with a final order in 1971,⁴⁴ explored some of the knotty issues raised at the junctures between the telecommunications industry and the computer and data processing industries. Among other questions, the Inquiry considered whether services combining

data processing functions -- previously unregulated -- and communications functions -- pervasively regulated -- should be regulated by the FCC. Avoiding the broader questions raised, the Commission decided only that regulation would be inappropriate for certain of the new forms of
45 service. Some of these, the so-called "hybrid data processing services" are markedly akin to the services that will be provided by the divested ARPANET.

1. Hybrid Services

Defining "hybrid service" as an "offering of service
46 which combines Remote Access data processing and message-
47 switching to form a single integrated service," the Commission drew the regulatory line between "Hybrid Data Processing Services" and "Hybrid Communication Services." The hybrid communication service, defined as a "hybrid service offering wherein the data processing capability is
48 incidental to the message-switching function or purpose," would under the Order be subjected to regulation. The hybrid data processing service, described as "a hybrid service offering wherein the message-switching capability
49 is incidental to the data processing function or purpose,"

would, for the present, remain unregulated.

The Commission expressly rejected the argument raised in several quarters that it was "obligated by statute to regulate the 'hybrid service' as defined, insofar as such service contains a communication component."⁵⁰

As we have indicated in our Tentative Decision: It is our position that where message-switching is offered as an integral part of and as an incidental feature of a package offering that is primarily data processing, there will be total regulatory forbearance with respect to the entire service whether offered by a common carrier or noncommon carrier.⁵¹

The Commission had, in its Tentative Decision, offered some rules of thumb for application of the distinction:

If ... the package offering is oriented essentially to satisfy the communications or message-switching requirements of the subscriber, and the data processing feature or function is an integral part of and incidental to message-switching, the entire service will be treated as a communications service for hire, whether offered by a common carrier or non-common carrier and will be subject to regulation under the Communications Act. One applicable test will be whether the service, by virtue of its message-switching capability, has the attributes of the point-to-point services offered by conventional communications common carriers and is, basically, a substitute therefore. Another test will be the extent to which the message-switching feature of the service facilitates or is related to the data processing component, or whether such message-switching is essentially independent of such data processing. In effect, we shall address ourselves to the facts surrounding a package offering with a view toward determining the primary thrust of the service offered.⁵²

How the ARPANET would be characterized under these tests is far from clear. Two commentators have concluded, though without much further explanation, that the ARPANET, "if offered on a commercial basis to the public at large would, under the Commission's present rules, have to operate as a common carrier."⁵³ The issue is more slippery than this assertion might indicate, for though, to be sure, point-to-point service is the essence of the network, the service is hardly a substitute for those offered by conventional common carriers and, as an economic matter, the message-switching feature is at most secondary to the data-processing aspect with which it is closely related.

2. ARPANET: The Overlooked Threshold Questions

The real conceptual difficulty stems from the fact that ARPANET is generically distinct from the types of systems the Commission envisioned in the Inquiry. Where the Final Order contemplates a longitudinal division in a system's services, entailing, say, first transmission, then processing, then message-switching, ARPANET contemplates a division along latitudinal lines. Point-to-point communication lies at the heart of the system but, from start to finish, the messages transmitted will be processed, through

methods including disassembly, reassembly and changes within the bit packets and sometimes through encryption. That data processing of a more complex magnitude will be performed at various points in the system in no way renders the packeting process any the less data processing. Thus, it is conceptually more accurate to characterize the network as itself a unitary, fully integrated computer, with communication facilities employed internally to link one function to another.

These important technical differences aside, there are important policy reasons for withholding regulation from the divested network. By focusing on the question whether a new service's relationship to existing common carriers warrants regulation of the service, the Commission has to a significant extent ignored the larger, threshold question: whether the new service possesses those natural monopoly contours that historically have justified impositions of common carrier status. It is the major premise question -- whether the market to be occupied by ARPANET itself will possess natural monopoly contours -- and not the minor premise question -- whether existing common carrier service will somehow be prejudiced by the network's operation -- that

properly forms the starting point for inquiry. Having the tail wag the dog is not an unpardonable act in all circumstances, but when it results in foreclosed consideration of central economic questions, it deserves to be discouraged.

V. REGULATION BY THE MARKET

The preceding discussion suggests that interests in the efficient supply of a wide range of services will probably be best served by an ARPANET situated in a vigorously competitive environment free from significant government control, either through regulation as a common carrier or through ownership as a public firm. This means, first, that government should at some early point shed all or almost all of ARPANET's components into the private domain, retaining if any, only those few components perceived as critical to the network's continued functioning in the public interest. To be sure, even if a network firm

were structured along monopoly lines, there would be some element of competition in the sense that bidding for the monopoly franchise would be competitive and -- if the franchise were durationaly limited -- continual. From the available evidence, though, it seems unlikely that competition in this form would provide a high enough level of continued and properly focused investment in innovation, and a sufficient degree of diversity and economy in services, to justify taking this route over the more thoroughly competitive one.

Second, barriers to entry should probably be kept low and, more important, kept uniform: ARPA must be vigilant to assure that all prospective entrants are given equal access to existing technical knowhow, whether developed within ARPA or by its contractors. Equality of access will deprive any single firm of the sort of technological headstart that would likely lead to a monopoly position under present conditions; access on equal terms will help to stimulate the needed degree of competition and diversity, both nationally and regionally. Assuring entry by firms of the appropriate size and number -- the one justification for giving a firm or small number of firms the competitive advantage special access would entail -- appears, from the

facts available, to be attainable without these artificial inducements.

Although competitive conditions can be expected generally to discipline a network firm's operational decisions -- decisions respecting price, quality, marketing, material and labor and investment in plant and research and development -- toward achieving the larger welfare objectives established for the network, the degree of success achieved by market forces cannot be expected to be uniform for all decisions. There may be some concern, for example, that the competitive firm's decisions respecting the quality of its services may not comport with larger needs.

Specifically, there are two ways in which decisions on quality may depart from welfare norms. First, it may be feared that competitors will shave the quality of their services to a point beneath the standard of reliability essential to the network's integrity. The concern in this respect is that, absent regulation, breakdowns in quality might with distressing frequency go undetected until after their harm is done. When the harm is to highly sensitive interests, and threatens to be on a massive and unsettling scale, the need for prospective quality maintenance by an

institution other than the private firm, may be found compelling. It is perceived needs of this sort that sustain the Federal Food and Drug Administration and that may be seen as calling similarly for government supervision of network performance quality.

Second, because any element in the network should be able to interconnect with any other element in the network, there is the problem of compatibility and a consequent need for standardization of interconnection formats, the obvious comparison being to the early need for uniform gauge railroad track throughout the nation if rail transport was to enjoy any degree of efficiency. Indecision and wrangling among network members as to the appropriate interconnection standard to be employed could lead to serious dysfunctions at the network's outset. In a related area, the nascent home-use electronic video recording industry, conflict over standards has plagued the industry for years and may be the single most prominent factor in its failure so far to achieve viability. Even though there will be certain natural economies to standardization in the case of the ARPANET, and the various systems might be expected to shake down over time to a single standard, the critical questions are

how much time this will take and whether the losses to be sustained in the interim are sufficiently outweighed by the generalized advantages of strict reliance on the market.

Standardization and the maintenance of prescribed levels of service could be achieved under either the retention or regulatory techniques discussed in earlier sections of this paper. Government could, for example, retain responsibility for developing interface and service standards -- performing the task internally or by contract -- and could establish an agency to enforce the resulting rules. At least two other techniques, rooted in market rather than regulatory functions, are available for quality control within the evolved ARPANET. Under the first technique, government control would be accomplished through government purchase of services from the network, with the appropriate performance standards, presumably dictated by the government but tempered by negotiation, written into the service contract; this technique may be called "regulation by purchase."

Under the second technique, which may be called "regulation by cooperation," quality control would be administered by a cooperative board or trade association consisting of members elected by network participants. Like direct

regulation, regulation by cooperation has as its central effect the removal from individual firms of a set of operational decisions and, consequently, the constriction of firm behavior. If the effects of the two approaches, direct regulation and regulation by cooperation, are equivalent, their legitimacy is not. Because it vests in government decisions previously lodged in private firms, direct regulation is inherently legal. Regulation by cooperation, because it vests decisions not in government, but in a private superstructure, is immediately suspect for its possible anticompetitive effects. This suggests that if desired levels of quality cannot be achieved by leaving decisions exclusively to private firms, and that if cooperative decisionmaking would run afoul of the antitrust laws,
56 then direct regulation may be the appropriate solution.

A. REGULATION BY PURCHASE

The federal government will be a major -- and in the near term, the predominant -- purchaser of network services. Indeed, it may be said with some accuracy that the single most valuable asset to be received by successful ARPANET bidders is an implicit government agreement to purchase

their services. As a purchaser, government may be expected to exert some special influence on network operation: contracts might, for example, call for a government priority on the network's facilities and, in case of vital public need, for preemption of network time. Special governmental needs may also require the creation, either at government or bidder expense, of bypasses in heavily traveled areas to assure the unimpeded flow of government and other user messages when peak periods coincide with emergency conditions.

It is the more general formative effects of government purchase that are of interest here. The government, particularly if it acts through a single broker rather than through a number of independent departments, will be in a unique position to affect the way in which network decisions on quality are made. Just as government could, through retention or regulation, prescribe interface standards and levels of performance in terms of errors permitted, reliability and data rate, so it could, by specifying its criteria as to any or all of these in its purchase contracts, stimulate network participants to meet these standards voluntarily.

The extent to which performance requirements in government contracts will have a spillover effect, establishing network performance at the same level for all users, will depend upon economies of network operation not yet fully discernible. If the hardware and software built to government quality specifications might efficiently be deployed to meet the needs of private consumers as well, and if economies of scale counsel against the construction of redundant facilities for the commercial sector, then the spillover will be complete and the regulatory consequences most effective. The economies involved in standardization suggest that government initiative in this respect will prove decisive. Whether government leadership on other quality issues will be equally influential is open to question. Examination and comparison of the effects on private suppliers' decisions of compliance with government purchase requirements, as, for example, Department of Defense purchasing specifications for pharmaceutical and medical supplies, may prove instructive in this respect.

To the extent that compliance with government

specifications will not carry over to the supply of services to private users and thus will not produce standards in the private sector that the government deems to be in the public interest, government might alternatively require that, as a condition of obtaining government business, the network maintain a prescribed level of quality across the board. This technique, much like the one apparently employed by HEW in its patent policy for grants to universities, borders closely on direct regulation and may, to the extent that regulation is really its substance, best be replaced by direct regulation or avoided altogether.

The advantages of regulation by purchase, when it possesses extensive, if not complete, spillover effects, stem largely from its flexibility and specificity. To begin with, a market situation approaching the inflexibilities of the regulatory process would obtain only if government were a monopsonist, a position which, in connection with its purchase of network services, it would not occupy. Also, while administrative hearings on proposed common carrier tariffs do possess some of the elements of a Turkish bazaar, and while managers of regulated industries can be expected to have some say, informally and through the hearing

process, in the promulgation of rules governing their activities, their interests could probably be advanced and accommodated more effectively around the bargaining table.

Also, regulation's "tar baby effect," already alluded to,⁵⁸ under which regulation of one aspect of an industry may quickly lead to the need for regulation of another, and still another, aspect until a situation approaching complete government ownership results, can be avoided through the inclusion in purchase contracts of those specific parameters on which performance is desired.

B. REGULATION BY COOPERATION

General responsibility for prescribing and supervising the protocols and quality of network service might alternatively be vested in a cooperative organization or trade association consisting of network participants, with executive responsibility delegated to a governing board in which representation would be based on, among other factors, regional situation and user orientation. Membership in the association would, presumably, be open to all network operators and the form of governance would be democratic.

The problem with the cooperative approach lies in the phenomenon observed by Adam Smith two hundred years ago, that "People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public or in some contrivance to raise prices."⁵⁹ If trade associations are themselves generally unassailable on antitrust grounds, their decisions nonetheless invite frequent government scrutiny for anticompetitive effects. And, while the courts, the Justice Department and the Federal Trade Commission have all shown some tolerance toward cooperative endeavors respecting research, technical information exchange, advertising standards and safety programs,⁶⁰ even some of these decisions may be proscribed if untoward effects on price and quality competition are demonstrated.

Thus, for example, while association programs to standardize products and services are frequently sustained, standardization to any degree necessarily produces some anticompetitive effects: the firm serving consumers who desire substandard services is prejudiced and the standard itself may, by restricting supply, tend to rigidify price structures. Also, while one commentator has counselled that

attempts to promote standardization should, for this reason, "probably be limited to such noncontroversial matters as the safety, and possibly the durability and efficiency, of the product," even safety programs can be faulted on policy grounds: the consumer who prefers a lower price to more safety may find his range of choice constricted.⁶¹⁶²

While questions of antitrust liability pervade the cooperative technique, a question larger than restraint of trade stands at the threshold: whether decisions which on their face seem best placed under cooperative control should in fact properly be centralized. One question, whether a cooperative mechanism should be employed to allocate among hosts, differentially, rewards corresponding to the utility of their programs, may prove particularly nettlesome.

Absent some system of property rights, the host who invests heavily in the development of a new and useful program will, the program's high utility notwithstanding, be unable to recoup his investment: a competitor who has not similarly invested will simply cadge the innovator's technique and market it at a price equivalent to his marginal cost, a price that can be expected to be below the innovator's average cost. Unable to recapture his investment through the

price mechanism, the prospective innovator will be disinclined to innovate altogether, and one of the network's objectives, a high degree of program innovation, would be
63 defeated.

One remedy for this might be for the cooperative to tax all transactions and allocate the revenues among hosts in sums proportional to their contribution to the system. Cumbersome at best, a reward system of this sort would be largely unnecessary if present systems of monopoly subsidy -- patent, copyright and trade secret are the applicable candidates -- could be counted on to give to programs the kind and level of protection that would enable recovery of
64 research and development costs. Yet, as presently framed, these three bodies of law offer sparse incentive for investment in software innovation: the Supreme Court has recently rendered a decision casting considerable doubt over
65 the patentability of computer programs and, though programs are presently accepted for registration by the
66 Copyright Office, the level of protection accorded seems hardly worth the filing fee.

Protection of programs as trade secrets, a technique widely employed in the industry today, may be the answer for the

future network as well, particularly if the network's high degree of security can be relied on to guard against the unauthorized disclosure of proprietary data. Yet, here, too, the Supreme Court has raised troublesome questions, intimating that the trade secret monopoly may improperly conflict with the patent system and, for that reason, be invalid.⁶⁷ And, perhaps more important, reliance on a trade secret system may, since secrecy is its essence, undesirably inhibit the exchange of technical information and the development of new techniques from the teachings of preexisting knowledge -- one of the signal values of the patent system.

In any event, if trade secret protection endures, or if present systems are replaced by a new monopoly subsidy device for the protection of computer programs,⁶⁸ it would seem that reliance on the property system created, because consistent with the proposed generally competitive structure of the network, may be superior to a centralized system of rewards.⁶⁹ The problem of transaction costs -- measured in dollars and delay -- usually associated with the marketing of patents and copyrights need not obtain in the ARPANET, for the system's technology is uniquely situated to administer the bargaining and billing functions with a speed and efficiency not available in other industries.⁷⁰

CONCLUSION

This paper's central conclusion is that the goals set for a fully distributed, commercially operative ARPANET are most likely to be fulfilled through the network's divestiture to a number of independent firms situated in a vigorously competitive, relatively unregulated environment. The analysis leading to this conclusion, though grounded in legal and economic realities, may have appeared at times too arid for the complete comfort of ARPA policymakers who must soon make some hard decisions concerning the future of a project they have conceived and nurtured. For this reason, it may be helpful briefly to recast the analysis in terms that, somewhat more existential, provide a practical framework for immediate decision.

Because a question already decided -- should the network be expanded to a commercial scale? -- will necessarily influence the decisions that are to be made, ARPA planners might reconsider the question momentarily in their assessment of the network's future. The reason that the question was affirmatively resolved, is, of course, that the present network, linking a small club of academic and research centers, never was viewed as an end, but as a means, a first, experimental step in the direction of implementing a widespread, open-access multiservice system.

Implicit in this answer is a compelling lesson for future decisionmaking: means should not be confused with ends; repetition in a commercial setting of the conditions that led to the venture's success on an experimental scale may very well spell failure. This means, specifically, that the close, centralized control called for in the network's early stages may prove to be more of a hindrance than a help in its later stages and that, other things being equal, the structures required for the network's commercial success would be better patterned after the autonomous, market-disciplined structures employed in other commercial contexts.

Adherence to this larger view is especially critical now for, otherwise, ARPA planners, engulfed by demands unique to

the transitional period, might be led to decisions that could prove harmful in the long run. Thus, for example, transitional needs might tempt planners to look exclusively to present network contractors, familiar both with the system and to its present user community, for the interim provision of network services. Fear of breakdowns might also persuade the planners to impose stringent regulatory controls on the network's operation. Both temptations should be resisted because, (1) to act on them affirmatively would seriously jeopardize the network's prospects for attaining success as a commercial enterprise and (2) equally effective alternatives exist, less hazardous than exclusive reliance on present contractors and regulatory controls, under which security and reliability can be maintained in the near term.

Four action-oriented proposals can be drawn from these observations and from the paper's analysis generally:

1. Exclusive reliance for network services on any present contractor should be avoided in the near term.

Our economy has characteristically and, it would seem, successfully relied on competitive markets to provide the widest variety of goods and services at the lowest prices. Our antitrust laws are predicated on the belief that competition, not monopoly, will sustain welfare objectives. Divestiture to a single contractor would produce an immediate monopoly

situation in the network market. More important, for a firm to receive a monopoly position now would, through the competitive edge afforded, place it in a position over the longer term to bar entry to prospective competitors. In sum, monopoly in the short term will, more likely than not, defeat the prospects for competition in the long term.

2. Promulgation of regulations for the network's operations should be avoided in the near term.

The success of competitive markets in attaining welfare objectives has largely been achieved by lodging in private firms, rather than in governmental bodies, the power to make decisions respecting firm behavior. Under this view, private managers goaded by the profit motive will better respond to consumer demand than will governmental agencies not similarly motivated. Regulation is warranted only when it is demonstrated that decisions reached in private markets will not, for one reason or another, comport with larger social goals.

There is no reason to believe that network decisions privately reached will -- in the near or long term -- disserve social goals. Simply, there is no reason for regulation. Further, the danger exists that the imposition of regulatory controls in the transition period will so structure the network's operations that any real network capacity to meet consumer demand over the long run will be defeated.

3. Regulation of network operations by the FCC should be resisted.

Just as monopoly effects and regulation generally should be avoided, so should ARPA resist all efforts by the FCC to assume supervisory control over network operations. FCC control would likely place the network in a common carrier status, effectively depriving network operations of any significant degree of competition. Further, FCC supervision can be expected to result in regulation of the most extreme form, with the Commission second-guessing the decisions of private managers in critical areas -- innovation, expansion and price. As the federal agency possessing exclusive expertise in ARPANET's affairs, ARPA should actively urge the FCC to stay its regulatory hand.

4. The goals of regulation -- reliability and security -- can be better achieved through the use of the bargaining power implicit in government purchase contracts, and ARPA should take every possible step in the direction of consolidating government's position as purchaser.

The reason our economy generally relies on private firms, rather than on legislatures and regulatory agencies, to shape firm decisions respecting price and quality is that, given the profit motive, the firm is the institution best placed to respond to consumer demand. Stated slightly differently, this

proposition assumes dramatic relevance to the options facing ARPA planners: because consumer choice is the economy's touchstone, the question facing any economic planner is, in a very real sense, not whether decisional power should be lodged in government or in the firm but, rather, whether it should be lodged in government or the consumer.

Because government is both a prospective regulator and a prospective consumer of the services to be provided by the divested ARPANET, it will be doubly placed to influence network decisions. Because, as applied to the ARPANET, the regulatory process will suffer formative deficiencies not shared by the purchasing process, it is the latter that recommends itself as a means for directing network decision in the desired directions, particularly since, unlike exercises of the regulatory power, exercise of the purchasing power will naturally diminish in effect precisely at the times when diminished effects will be most appropriate: as the network moves, in the longer term, toward a larger, more varied, commercially oriented customer base. This suggests that if the network's basic die will be cast through the inclusion in government purchase contracts of performance criteria, then the die will be most effectively formed if the criteria set are uniform for all government agency purchasers. This suggests, in turn, the crucial role that can be played by ARPA acting as purchasing and contracting agent for all federal government network users.

FOOTNOTES

1. Recognition that this is an optimum, not likely to be realized in practice, does not necessarily imply that all steps taken in the direction of attaining the optimum will place the network in a better position than would have obtained had the steps not been taken. By way of comparison, economics' general theory of second best states that when one or more of a set of optimal conditions are not fulfilled, there is no reason to believe that the optimum can be approached by fulfilling or approximating more closely more of the conditions rather than fewer. See, e.g., Lipsey & Lancaster, The General Theory of Second Best, 24 Rev. Econ. Studies 11 (1956).
Whether or not there is a technological counterpart to the general economic theory of second best, any such theory would appear inapplicable to the ARPANET which, as a service institution comprised of many discretely operative components, would seem effectively placed to enjoy incremental advances in internal efficiency. This is not to say, however, that steps toward the network's optimum will not produce disproportionate second order effects -- both technological and economic -- generally, or even to say that the network's operation at its own technological optimum will more likely tend to advance social welfare than operation short of the optimum. Thus, it is entirely possible that a system enjoying

far fewer internal efficiencies than the one proposed will be preferable from an overall welfare perspective, as measured by allocative effects on other sectors of the economy. Analysis at this level, however critical, is beyond the scope of this paper, and when the term "welfare" is employed it is intended only to represent the limited public interest in a system working at the described technical optimum.

2. This catalogue of firm decisions is an abridgement and condensation of a more extensive, though summary, list set out in McKie, Regulation and the Free Market: The Problem of Boundaries, 1 Bell J. of Econ. & Man. Sci. 6,7 (1970).
3. 47 USC § 201 (b) (1970).
4. To the significant extent that public firms must compete with private firms in product, labor and capital markets, factors affecting public firm input decisions approximate those affecting private firm input decisions. While government's power of eminent domain might appear to give the public firm an edge on inputs unavailable to the private firm, the significance of the edge is limited by the facts that government must pay fair market value for property condemned and that, as a result of both public and private law decisions, private firms are increasingly coming to enjoy the substance if not always the form of eminent domain power.
5. It may be objected that the force of this distinction between public and private goals depends upon the view that firms pursuing private goals will be exclusively profit maximizing and that the distinction is blunted if, as has been argued, "planning," not profits, constitutes the objective of at least the larger firms. Compare J. Galbraith, The New Industrial State (1967) with W. Mueller, A Primer on Monopoly and Competition 160-175 (1970). See generally, G. Stocking & M. Watkins, Monopoly and Free Enterprise 491-529 (1951). See also, Hearings on Planning, Regulation, and Competition before the Subcomm. on Retailing, Distribution, and Marketing Practices and the Subcomm. on Monopoly of the Senate Select Comm. on Small Business,

90th Cong. 1st Sess. 1-45 (1967) (debate between W. Adams, J. Galbraith, W. Mueller, and D. Turner). However, it is not at all clear that in adopting planning as its goal, a firm is forsaking profits in any but the most limited sense. What is more likely is that it is shirking immediate profits for profits in the longer term. A firm or industry may, for example, voluntarily curtail its contaminant emissions, and suffer diminished present profits, on the hope that it will thus avoid public hostility and forestall future regulation that would cut more deeply into its operations. The force of the distinction -- and, indeed, the case for regulation -- might appear weakened by this last observation: to the extent that the firm plans with the objective of currying public and legislative favor, its operations can be expected to comport with public goals. The problem is, however, circular: absent regulation, or perhaps more important, the threat of regulation -- the firm would have no incentive to plan in these directions. If anything complicates the distinction between private and public objectives, it is that the pursuit of private goals through unfettered markets is in this country itself a cardinal public goal.

6. "Any regulatory commission that tries to control these effects by regulating additional variables such as cost performance, executive salaries and perquisites, choice of technical methods and rates of innovation, will quickly find its hopes to economize the means of regulation evaporating. As it extends further into the network of enterprise decisions it may discover that still other compensatory changes partly frustrate its efforts, and there are always more just over the horizon. Extension of control in response to perpetually escaping effects of earlier regulation may be called the 'tar-baby effect', since it usually enmeshes the regulatory authority in a control effort of increasing complexity with little gain in efficiency but a growing feeling of frustration."

McKie, Regulation and the Free Market: The Problem of Boundaries, 1 Bell J. of Econ. & Man. Sci. 6, 8-9 (1970).

7. Jones, An Example of a Regulatory Alternative to Anti-trust: New York Utilities in the Early Seventies, 73 Colum. L. Rev. 462, 465 (1973).
8. For one comparative study, see Davies, The Efficiency of Public versus Private Firms, The Case of Australia's Two Airlines, 14 J. L. & Econ. 149 (1971).
9. At the same time, significant income-based disparities in access have been successfully avoided in the pricing of residential telephone services. See, Bureau of the Census, Current Population Characteristics, Characteristics of Households with Telephones, Table I (Series P-20, No. 46, 1965).
10. Both instances are closely and imaginatively explored, the first by analogy, the second directly, in DeVany, Eckert, Meyers, O'Hara & Scott, A Property System for Market Allocation of the Electromagnetic Spectrum: A Legal-Economic Engineering Study, 21 Stan. L. Rev. 1499 (1969).
11. See generally, B. Hibbard, A History of the Public Land Policies (1939); Davidson, Government Role in the Economy, 48 J. Urban L. 1, 3-4 (1970).
12. 43 USC § 164 (1970). Under the original act, 12 Stat. 392 (1862), the required term was five years.
13. DeVany, Eckert, Meyers, O'Hara & Scott, A Property System for Market Allocation of the Electromagnetic Spectrum: A Legal-Economic Engineering Study, 21 Stan. L. Rev. 1499, 1531 (1969).
14. There are two arguments for the position that a renewal

system will exert a contrary, pro-innovation effect or, at the least, will be no less conducive to innovation than a scheme of perpetual ownership. First, if renewal is made to depend, explicitly or implicitly, upon some level of commitment to innovation, the desire for renewal can be expected to goad the firm to undertake a desirable amount of innovation. This assumes, however, that an administrative agency can safely prescribe level of commitment with a fair degree of certainty -- an unlikely enterprise given the unpredictable nature of innovation -- for, to the extent that the prospective standard is uncertain, the firm will discount the value of renewal by the risk of non-renewal. And, to the risk factor must be added the transaction costs of the renewal process. The argument assumes, too, that both the direction and level of innovation prescribed by the agency charged with administering the renewal program will be at least as desirable as the direction and level identified by consumer decisions in the marketplace.

Second, it may be argued that the firm whose license is not renewed is, in any event, in no worse a position than the firm which, enjoying a position of perpetual ownership, decides to sell off its assets. The problem here stems from the significant extent to which the value of a firm's assets will lie in the relative modernity of the firm's software. An agency decision that the firm's programs possess an insufficient degree of innovative thrust to qualify for renewal can be expected to depreciate the assets in the eyes of a prospective purchaser which, to gain agency approval for its operation, would probably be inclined to proffer an entirely new system or, at the least, one that bore few of the characteristics of its predecessors'.

15. See supra, p. 25.

16. See generally, H. Levin, The Invisible Resource: Use and Regulation of the Radio Spectrum (1971); Coase, The Federal Communications Commission, 2 J. L. & Econ. 1 (1959); cf. President's Task Force on Communications Policy, Final

Report ch. 8 at 28-40 (1968).

17. See DeVany, Eckert, Meyers, O'Hara & Scott, A Property System for Allocation of the Electromagnetic Spectrum: A Legal-Economic Engineering Study, 21 Stan. L. Rev. 1499 (1969).
18. See DeVany, Eckert, Meyers, O'Hara & Scott, A Property System for Market Allocation of the Electromagnetic Spectrum: A Legal-Economic Engineering Study, 21 Stan. L. Rev. 1499, 1531 (1969).
19. Omitted from this list of assets are the main computers situated at each host which, under varying arrangements, have been provided to the hosts by ARPA. The disposition of these facilities has been excluded from this study.
20. See supra, p. 15.
21. See, generally, Bork & Bowman, The Crisis in Antitrust, 65 Colum. L. Rev. 363, 366-368 (1965).
22. See Allen, Vertical Integration and Market Foreclosure: The Case of Cement and Concrete, 14 J.L. & Econ. 251, 255-272 (1971). A network developer of proprietary data may, however, respond to the general danger that, through leakage, his trade secrets will lose their secrecy and, consequently, their legal protectability. To the extent that leakage appears less likely to occur in the internal transfer of data than through their licensing to outsiders, this factor may be seen to produce one integration economy.
23. Compare Blake & Jones, In Defense of Antitrust, 65 Colum. L. Rev. 377, 392 (1965).

24. Several of the Canadian provinces stand with the United States as the important exception to this general approach.
25. See Posner, Natural Monopoly and its Regulation, 21 Stan. L. Rev. 548, 592-620 (1969), for a generally balanced assessment of the costs and benefits associated with regulation of public utilities and common carriers.
26. The prospect that regulation will, or can, be structured under Title III, "Special Provisions Relating to Radio," appears sufficiently unlikely not to warrant consideration here.
27. See generally, Goldstein, Information Systems and the Role of Law: Some Prospects, 25 Stan. L. Rev 449, 461-470 (1973). Similarly, the prospects for UHF's growth were early stunted by the Commission's failure to put the new industry in a position to compete with the already established VHF system. See generally, Note, The Darkened Channels: UHF Television and the FCC, 75 Harv. L. Rev 1578 (1962); Webbink, The Impact of UHF Promotion: The All-Channel Television Receiver Law, 34 L. & Contemp. Prob. 535 (1969).
28. For example, in Microwave Communications, Inc., 18 FCC 2d 953 (1969), petitions for reconsideration denied, 21 FCC 2d 190 (1970), and the ensuing rulemaking, First Report and Order in Docket No. 18920, 29 FCC 2d 870 (1971), the Commission granted free entry to specialized carriers which, in competition with Bell and Western Union, proposed to offer point to point microwave relay services specially tailored to meet the needs of the business and data transmission communities. In neither proceeding was the Commission persuaded by the existing carriers' argument that entry would enable the specialized carriers to reap the rewards available in highly profitable markets without at the same time being required to serve unprofitable markets, an argument rooted in regulated industries' common practice of differential pricing, employing supranormal profits from one area to subsidize activities in others where services are provided at less than average cost. While, on balance, systems of cross-subsidy pricing generally may be demonstrated to do more harm than good,

the Commission skirted the basic welfare question and rested its decision and order instead on the view that to permit entry would not only promote satisfaction of presently unmet needs but would also spur the existing common carriers to provide improved, more competitive service in the areas to be served by the new, specialized carriers.

For the cross-subsidizer, the obvious competitive response to a specialized carrier's cream-skimming is the one subsequently made by Bell and Western Union -- dropping prices in the formerly highly profitable markets to meet or undercut those of the newcomer, subsidizing these drops through increased prices elsewhere. Compare Baumol & Walton, Full Costing, Competition and Regulatory Practice, 82 Yale L. J. 639 (1973) with Noll & Rivlin, Regulating Prices in Competitive Markets, 82 Yale L. J. 1426 (1973).

Particularly if, as has been shown, competition will best serve the interests of network users, there is every reason for the MCI rationale to apply with at least equal force to answer any charge that a divested ARPANET would improperly be skimming the cream from established common carrier operations.

29. Essentiality to the community of the service in question has been cited as a third factor indicative of natural monopoly conditions. Irwin, The Computer Utility: Competition or Regulation?, 76 Yale L. J. 1299, 1313 (1967). This factor appears, however, to be not so much a predicate for natural monopoly as a description of some of the services provided by some public utilities and common carriers. A number of essential services and products -- health care and food are examples -- are provided under truly competitive conditions, while many of the services provided under natural monopoly conditions, many of Bell's regulated offerings, for example, can only be characterized as non-essential.
30. One result to be expected from the FCC's MCI decision, and the ensuing rulemaking, see supra, n. 28, is the proliferation of special function transmission systems

throughout the country, frequently existing side-by-side. Especially as augmented by domestic satellite transmission capabilities, see generally, Mathison & Walker, Regulatory and Economic Issues in Computer Communications, 60 Proceedings of the IEEE 1254, 1264-1268 (1972), the future transmission picture reveals a multiplicity of competing transmission services, including Bell and Western Union services, from which the user of transmission facilities will be able to select the one best priced and situated to meet his individual needs.

What is critical about ARPANET's place in this picture is that it will be an entity consisting of users of transmission facilities -- flexibly employing telephone, microwave and satellite links -- and not a carrier -- providing the necessary links. This suggests not only that the network market lacks the natural monopoly characteristics that traditionally call for common carrier treatment, but also that (1) existing common carriers would have good reason to encourage entry by a large number of network firms which, in competing for the sale of new communications services, can be expected to increase overall use of common carrier facilities and (2) to the extent that an existing carrier's objection to the entry of new firms is grounded in its own hopes of entering the network business, the argument reveals a carrier attempt to reach into untapped fields rather than a network attempt to enter the already tapped common carrier industry.

31. The argument that firms enjoying a monopoly position will be counter-innovative or, at least, will invest in the least efficient forms of innovation, rests on a number of assumptions --- among them, that monopolists, because they are less cost-conscious than competitive firms, will be less concerned with cost-reducing and efficiency-promoting innovations; that the monopolist will either under-invest in research and development generally, or will overinvest to forestall entry when part of its monopoly market is competitively threatened; and that the monopolist will invest in research and development designed to buttress its monopoly position by extending scale economies and reinforcing other barriers to entry. See,

for example, Shepherd, The Competitive Margin in Communications, in W. Capron ed., Technological Change in Regulated Industries 86 (1971).

For a particularly effective rebuttal of the argument, see Posner, Natural Monopoly and Its Regulation, 21 Stan. L. Rev. 548, 577-584 (1969).

32. Although it has been commonly supposed that regulation tends to inhibit innovation, "an apparent paradox is also recognized -- if regulation has inhibited the pace of innovation, why have all the regulated industries enjoyed long-term productivity increases that are above the national average (and certainly higher than those in most manufacturing industries)?" Capron ed., Technological Change in Regulated Industries 3 (1971). In part, however, this general level of performance can be attributed not to regulation but to the surrounding natural monopoly conditions that called for its exercise -- capital intensity, economies of scale -- conditions that themselves would appear to enhance innovation. Id. at 221.
Regulation's counter-innovative effects in the communications industry have been carefully documented in Shepherd, The Competitive Margin in Communications, in id. at 86, which concludes that more, rather than less, competition in the industry will best conduce to a desirable pace and direction of innovation.
33. The general bias, commonly called the "Averch-Johnson effect," is considered in Averch & Johnson, Behavior of the Firm Under Regulatory Constraint, 52 Am. Econ. Rev. 1052 (1962).
34. Bell's expenditures on the Picturephone -- tremendous when compared with its commitment to the development of digital transmission services, see Mathison & Walker, Regulatory and Economic Issues in Computer Communications, 60 Proceedings of the IEEE 1254, 1255 (1972) -- provides a good example of wrongly directed investment in innovation. The quality of Picturephone service is far from adequate, not because the research was done on the cheap, nor because the system lacks sophistication

and considerable ingenuity, but rather because the extensive network of transmission facilities to which the Bell System is tied are just not set up for two-way video transmission. Much less research and development would have been needed to produce a system able to work better on some other transmission basis.

35. To some extent, this phenomenon was credited by the FCC in Use of the Carterfone Device in Message Toll Telephone Service, 13 FCC 2d 420 (1968). Issuing a sweeping condemnation of the carriers' foreign attachment tariffs (which prohibited use of hardware not obtained from carrier affiliates) to the extent that they were unnecessary to the maintenance of system integrity, the Commission immediately stimulated competition and innovation in the attachment hardware industry. See generally, Irwin, The Telecommunications Equipment Market -- Public Policy and the 1970's, Fall Joint Computer Conference 269, 270-272 (1970).
Carterfone is at least indirectly relevant to the prospects for a divested ARPANET on two counts: first, in its broadest aspect, the decision reflects a policy that, when faced with new technological entities seeking connection with present carrier facilities, the Commission will place the burden on the carrier, to establish that connection would materially impair the carrier's services, and not on the proponent, to establish that it would not. Second, by stimulating competition and innovation in the attachment hardware industry, Carterfone has dramatically increased the technological options available to network participants, in terms of both their freedom to fashion equipment to meet their special requirements and to purchase needed systems and devices in the market at competitive prices.
36. 47 USC §§ 151-509 (1970).
37. The FCC's authority under Title II is, of course, confined to interstate and foreign carrier operations. It is en-

tirely possible that the states, probably through their public utility commissions, and even some municipalities, will attempt regulation of intrastate network activities as they have done, to varying degrees, with CATV systems. See generally, Barnett, State, Federal, and Local Regulation of Cable Television, 47 Notre Dame Lawyer 685 (1972).

38. 47 USC § 154 (i).
39. Second Report and Order in Dockets 14895, 15233, 15971, 2 FCC 2d 725 (1966).
40. United States v. Southwestern Cable Co., 392 U.S. 157, 178 (1968):

There is no need here to determine in detail the limits of the Commission's authority to regulate CATV. It is enough to emphasize that the authority which we recognize today under § 152 (a) is restricted to that reasonably ancillary to the effective performance of the Commission's various responsibilities for the regulation of television broadcasting.

41. 47 USC § 153 (n). The full definition reads:

'Common carrier' or 'carrier' means any person engaged as a common carrier for hire, in interstate or foreign communication by wire or radio or in interstate or foreign radio transmission of energy, except where reference is made to common carriers not subject to this chapter; but a person engaged in radio broadcasting shall not, insofar as such person is so engaged, be deemed a common carrier.

42. Statement of Managers on the Part of the House, Conference Report on Communications Act of 1934, H.R. No. 1918, 73d Cong., 2d Sess., 45-46 (1934).

43. Notice of Inquiry, Docket 16979, 7 FCC 2d 11 (1966).
44. In the Matter of Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Services and Facilities, Docket No. 16979, Final Decision and Order, 28 FCC 2d 267 (1971).
45. "...[I]n view of all the foregoing evidence of an effective competitive situation, we see no need to assert regulatory authority over data processing activities whether or not such services employ communications facilities in order to link the terminals of subscribers to centralized computers." 28 FCC 2d 291, 298 (1970).
46. "'Remote Access Data Processing Service' is an offering of data processing wherein communications facilities, linking a central computer to remote customer terminals, provide a vehicle for the transmission of data between such computer and customer terminals." 47 C.F.R. § 64.702 (4) (1971).
47. 47 C.F.R. § 64.702 (5) (1971).
48. 47 C.F.R. § 64.702 (5) (ii) (1971).
49. 47 C.F.R. § 64.702 (5) (i) (1971).
50. Final Order in Docket No. 16979, 28 FCC 2d 267, 277 (1971).
51. Final Order in Docket No. 16979, 28 FCC 2d 267, 277 (1971).
52. Tentative Decision in Docket No. 16979, 28 FCC 2d 291, 305 (1970).

53. Mathison & Walker, Regulatory and Economic Issues in Computer Communications, 60 Proceedings of the IEEE 1254, 1259 (1972).
54. Characterization of network operations as hybrid data processing services rather than as hybrid communications services may possess for network firms specific and important economic consequences distinct from those flowing from the Commission's general regulatory activities. Under the "authorized user" provisions of their tariffs, existing common carriers are constrained not to lease circuits to customers whose use would involve third party communications, essentially replicating the type of service provided by the carriers themselves. The effects upon network firms of a carrier denial under its authorized user provisions are different and certainly more immediate than Commission characterization and regulation of the firm as a common carrier: entry is chilled from the outset at existing carriers' private initiative. The history of the Bunker-Ramo Corporation's efforts to lease Bell and Western Union lines for its Telequote IV service, and particularly Bell's response to the request, are instructive:

Although these conclusions have some factual support in the material which accompanies the legal opinion, we are unable to conclude that the transmission of communications from one person to another is, or will remain, merely an incidental factor in Bunker-Ramo's plan. Indeed, it would appear that the transmission of communications is at the very heart of its proposal for "message switching" services, which services might prove, in fact, to be a most significant element of Telequote IV. The so-called "data processing" functions, to the extent that they exist at all in such cases, might be deemed ancillary to the transmission of communications and of subordinate importance. In such circumstances we believe a conclusion that Bunker-Ramo was not engaging in a common carrier undertaking subject to regulation under the Communications Act would be open to serious question.

Letter from American Telephone & Telegraph Co. to FCC, Sept. 29, 1965 at 2.

The history of the Bunker-Ramo affair is recounted in Irwin, The Computer Utility: Competition or Regulation? 76 Yale L. J. 1299, 1306-1308 (1967); D. Smith, The Interdependence of Computer and Communications Services and Facilities: A Question of Federal Regulation, 117 U. Pa. L. Rev. 829, 848-849 (1969), and more recent developments, in Comment, Federal Communications Commission Regulation of Domestic Computer Communications: A Competitive Reformation, 22 Buffalo L. Rev. 947, 961 (1973).

55. It is at best risky to speculate on the role that nomenclature plays in regulatory decisions, but it is entirely possible that the chance, academic characterization of early networks cognate to ARPANET as "computer utilities" played some part in the Commission's decision to view them as suggesting regulation as public utilities. The term has, for better or worse, fallen into common parlance. See, e.g., D. Parkhill, The Challenge of the Computer Utility (1966); Irwin, The Computer Utility: Competition or Regulation? 76 Yale L.J. 1299 (1967). Paul Baran's early observation that "in essence ... computer 'utilities' are not utilities" deserves more attention than apparently it has been given:

The computer 'utility' user is not restricted to doing business with any one company. If you are not satisfied with your service, or are concerned about price, you can always "go" elsewhere. Similarly, any single computer installation is not forced to serve all potential customers on an equal basis. The big customer may expect preferential treatment, either in terms of price charged or speed of service.

P. Baran, The Coming Computer Utility -- Laissez-Faire, Licensing or Regulation? (1967).

56. The terms of choice need not always be so stark for, in practice, the presence of informal oversight, rather than direct regulation, by a government agency may save an otherwise illegitimate restrictive practice. Thus, it has been suggested that under the codes of the National Association of Broadcasters the concerted refusal by

broadcasters to air, among other advertisements, those promoting the sale of liquor, may be tolerated because of the FCC's general surveillance of the broadcast industry. Levin, The Limits of Self-Regulation, 67 Colum. L. Rev. 603, 633-635 (1967).

57. Decisive because so long as no network operator has an investment in, and consequently, commitment to, any interface standard, each will be better off in adopting a standard that it knows will be adopted by all or most.
58. See supra, p. 20.
59. A. Smith, Wealth of Nations, Book I, ch. 10, pt. II (1776).
60. See Monroe, Practical Antitrust Considerations for Trade Associations, 1969 Utah L. Rev. 622-623 (1969). See generally, Borowitz, Joint Business Actions by Competitors: Are Any Permissible? 32 Ohio State L.J. 683, 689-698 (1971); Levin, The Limits of Self-Regulation, 67 Colum. L. Rev. 603, 633-635 (1967).
61. Monroe, Practical Antitrust Considerations for Trade Associations, 1969 Utah L. Rev. 622, 625 (1969).
62. See Turner, Consumer Protection by Private Joint Action, 1967 N.Y. State Bar Ass'n Antitrust L. Symposium 36, 40. This position assumes, of course, that social welfare will best be served by the availability of the widest possible variety of goods and services, and necessarily ignores the persuasive argument that, as a function of overinvestment, some variety increases may be undesirable from the welfare standpoint. Cf. Markovits, Fixed Input (Investment) Competition and the Variability of Fixed Inputs (Investment): Their Nature, Determinants and Significance, 24 Stan. L. Rev. 507 (1972).

63. See generally, Arrow, Economic Welfare and the Allocation of Resources for Invention, in Nat'l Bureau of Economic Research, The Rate and Direction of Inventive Activity: Economic and Social Factors 609 (1962).
64. Even with an adequately functioning system of monopoly subsidy, some program of rewards for major achievements, or prizes for attaining desired performance criteria, might provide a needed, auxiliary goad to innovation.
65. Gottschalk v. Benson, 409 U.S. 63 (1972).
66. Copyright Office Circular 31 D (May 1964). See generally, Cary, Copyright Registration and Computer Programs, 11 Bull. Copyr. Soc. 362 (1964).
67. Lear, Inc. v. Adkins, 395 U.S. 653, 674-675, 676-677 (1969).
68. See, e.g., Gaidi, Proposal for New Legislation to Protect Computer Programming, 17 Bull. Copyr. Soc. 280 (1970).
69. Compare Baxter, Legal Restrictions on Exploitation of the Patent Monopoly: An Economic Analysis, 76 Yale L.J. 267, 273-274 (1966).
70. See Goldstein, Information Systems and the Role of Law: Some Prospects, 25 Stan. L. Rev. 449, 454 n. 15 (1973).